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ON CORPUSCULES OF THE OUTER ATMOSPHERE

by

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It was thought before the launching of Sputniks that illumination, heating and ionization of the upper atmosphere are mainly due to the hard electromagnetic radiation of the Sun. It was assumed only for the Polar regions that the solar corpuscules (charged particles : protons, α - particles and electrons) may penetrate into the atmosphere, while geomagnetic disturbances and aurorae are occuring. The study of spectra of these aurorae showed that they are frequently caused by protons with a sizable range of speeds. However, no hydrogen emission was observed in many cases. Here again the aurorae was presumably explained by not very hard electrons of up to hundreds and thousands of ev penetrating into the atmosphere.

An attempt was made to discover these not very hard electrons by the third sputnik. Two very thin fluorescent screens with aluminium foils of different thickness were used as indicators. The emission of the fluorescent screens was received by a photoelement. The photocurrent was then amplified. An electric signal was transmitted to a memory system and then by radiotelemetry transmitted to the earth. By using metal foils of different thickness it was possible to estimate both the intensity and the energy of the electrons that produced the greatest fluorescence on the screen. The peculiarity of the instrument was in its reaction practically only to electrons, without recording protons and photons of the same energies. As a result powerful fluxes of electrons of about IO kev were recorded at heights up to I900 km in the south Pacific. The intensity of these fluxes was very high in the majority of cases the instruments appeared to go off scale, since such high intensity was not expected. The effective energy of electrons was observed to be less in the polar regions. The energy flux of the electrons studied exceeded IOO erg cm^{-2}sec^{-1} at the height up to I900 km at the moment of

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going off scale. If the electron fluxes of the indicated intensity had penetrated into the lower layers of the atmosphere, i.e. the F-region of the ionosphere, they could not remain unnoticed since they would essentially increase ionization of the upper atmosphere and lead to the appearance of aurorae. Since no such phenomena was observed, the recorded fluxes were explained to be electrons oscillating along the magnetic field lines (July 1958, Fifth Meeting of CSAGI).

Thus, information was obtained about the accumulation of electrons of about 10 kev at great heights up to 1900 km. All other explorations known to us refer to much lower altitudes and cannot be an indication of the existence of a magnetic trap around the earth.

The majority of not very hard electrons move along the directions normal to the magnetic field lines. The electron flux downward is greater than upward. The dependence of effective energy of the discovered electrons upon the direction of the electron motion with respect to the magnetic field lines is illustrated. Since the angle subtended by the indicators was 1/4 steradian, the diagram shows that the opposite motion of electrons from the earth near the magnetic field lines is practically absent. The electrons moving to the earth were observed even under small angles to the magnetic field lines. This indicates that the particles penetrating to the lower layers of the atmosphere appear as a result of some processes at the heights exceeding 1900 km. It has been found out that the energy of electron fluxes able to reach the F-layer of the ionosphere without reflection can reach values about 1 erg $cm^{-2}sec^{-1}$. Partial increases of intensity of corpuscules were registered above the Pacific even at $-4°$ of geomagnetic latitude at the height of 1500 km, as was already reported in the material published.

It is no exageration to say that the powerful flux of the electrons, discovered in the upper atmosphere, is of extreme importance in understanding many important processes, although it creates no threat for astronautics. It is of interest to note that sizeable intensities of such electrons begin to appear at that geomagnetic latitude, where in the F-region of the ionosphere one observed the increase of ionization also before but which couldn't be explained by the effect of hard electromagnetic radiation of the sun. Some inhomogeneities in the ionization of the upper atmosphere and the system of ring currents around the earth can be explained by the existence of such corpuscules. The dependence of the temperature variations and the density of the upper atmosphere upon the solar activity becomes more understandable now, since the corpuscules, the intensity of which is

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governed by the solar activity, are the sources of heating. The heat flux brought by these electrons can well account for the increase of temperature with height and latitude, which could not be ascribed to the hard electromagnetic radiation of the sun alone.

The problem of great accumulation of hard particles in the upper atmosphere is now widely discussed among geophysicists and astrophysicists and there are different viewpoints on the problem.

Harder corpuscules, discovered in the upper atmosphere are of no geophysical importance. They cannot essentially change the state of the upper atmosphere since their power is small. However these hard corpuscules, as well as x-radiation arising in the earth's atmosphere and in the body of rockets and sputniks while they are irradiated by these electrons of energies of tens of kev, are very unpleasant for astronautics, since the dose of dangerous radiation may reach tens of roentgens per hour.

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3.2I MEASURING THE MAGNETIC FIELDS OF THE EARTH AND MOON BY MEANS OF SPUTNIK III AND SPACE ROCKETS I AND II

by

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ABSTRACT

Measuring the Earth's magnetic field by Sputnik III

The principal problems of geomagnetic measurements by means of artificial satellites and rockets have been considered by Pushkov and Dolginov.

The aim of the experiments was :

a) to obtain experimental data on the spatial distribution of the magnetic field about the earth and on its variations in time ;

b) to separate, on the basis of these data, the geomagnetic field into fields of inner and outer origin;

c) to determine the location of sources of the general field, of secular variations, of world-wide magnetic anomalies, of diurnal variations and magnetic storms ;

d) to determine the nature of solar corpuscular streams that are responsible for magnetic storms ; namely, to find out whether they consist of particles of one sign or of particles of different signs and are electrically neutral.

The magnetic measurements by Sputnik III were carried out between May I5 and June 5, I958 (20 days). They consisted of measurements of the scalar magnitude of total magnetic-field intensity by means of a full-vector self-orienting magnetometer. Measurements obtained yielded numerous data on the intensity of the magnetic field over U.S.S.R. territory at altitudes from 800 to 225 km. Data referring to greater heights, up to I880 km. were obtained only in the Southern Hemisphere, and they are

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scanty. The total length of the trajectory paths of the satellite over USSR territory that has yielded data comes out to about 80,000 km.

There are several hundred points over which the satellite passed a few times at different times and at different altitudes, in some cases in direct circuits and in others, in return circuits. There are also cases when the satellite passed over quite considerable distances twice moving along one and the same arc or along close arcs, but at different heights. All these cases are equivalent to magnetic measurements by rocket and yield much interesting material for purposes of comparison. The measurement data at such points were utilized :

a) for control of the functional behaviour of the magnetometer ;

b) for determining the magnitude of the gradient of the field intensity at the altitudes of satellite flight ;

c) to clarify the nature of field variations at altitudes during magneto-ionospheric disturbances.

Analysis of many of the numerical measurements obtained by Sputnik III continues. The results of analysis will be published in papers by a number of authors. These papers are either in preparation for the press or are in the press.

At present we can draw the following conclusions :

a) the field gradients determined from measurements at the control points mentioned above proved to be very close to the values calculated theoretically by Vestin on the basis of a cumbersome analysis of epoch 1945 ;

b) the field gradients observed over the world magnetic anomaly situated in Eastern Siberia do not markedly differ from the field gradients observed in a normal field. This suggests that the causes of this anomaly should reside at roughly the same depths as the sources that produce the general magnetic field of the earth ;

c) the most considerable variations in the field gradients were observed at high latitudes. Here, the satellite passed at heights of the order of 350 km., that is, in the ionosphere. Not excluded, for this reason, is the fact that the variations in the field gradients are due, to some extent, to the magnetic field of electric currents in the ionosphere, which currents give rise to the diurnal variations and perturbations of the terrestrial magnetic field.

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Measuring the magnetic field in the outer radiation belt of the Earth.

Very exceptional, as to scientific results, are the results obtained in measuring the magnetic field by space rocket I and space rocket II, in the radiation belt of the earth. These measurements were carried out by devices consisting of three single-component magnetometers with magneto-saturated pick-ups of even harmonics that measured the field components along three mutually perpendicular axes fixed in the rocket container.

The magnetometers of space rocket II were designed to measure the magnetic field of the moon, and so their sensitivity was increased over that of the magnetometers of space rocket I by four times. Accordingly, the measurement range of the magnetometers was narrowed. This is why measurements of the magnetic field by space rocket II began, approximately, from I8,000 km. from the centre of the Earth, while on space rocket I they were begun at approximately I4,700 km. The measurement precision at these distances was, in the first case, about I00 gammas and, in the second, about 50 gammas.

The results of the field measurements by space rockets are given in Fig. I by curves of the differences between the measured values of the total field intensity and the theoretically calculated values of field intensity from the data of a spherical harmonic analysis. From this figure it will be seen that the magnetic field effects discovered by rocket measurements are associated with the outer radiation zone. They were explained by the superposition of the magnetic field of the outer radiation zone on the terrestrial magnetic field.

It was suggested that one of the most probable causes of magnetism in the radiation zone is the electric drift currents that arise due to the drift of charged particles of the radiation zone in the magnetic field of the earth. Further, in accord with present-day theories of the origin of magnetic storms and aurorae, it was thought that the outer radiation zone is formed by the penetration of solar corpuscular streams, consisting of neutral particles and of an equal number of positively and negatively charged particles (protons, positive ions and electrons), into the terrestrial magnetic field. In accordance with this assumption, it was expected that in the case of stronger streams creating stronger magnetic storms, particles will be retained closer to the earth than in the case of weak streams that create weaker storms. This assumption seems to be corroborated in Fig.2. Here, on the abscissa axis are plotted the distances, from the centre of the earth, of intensity maxima of corpuscular radiation from the measurements of Vernov, Chudakov et al by space rocket I

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and space rocket II and from the measurements of Van Allen by the Pioneer III space probe ; on the ordinate axis - the greatest decrease in mean-diurnal values of the horizontal component of the magnetic field at the Krasnaya Pakhra Observatory (near Moscow) during the most recent magnetic storms preceding measurements of the corpuscular radiation.

The results of corpuscular-radiation measurements by Van Allen on Pioneer IV likewise fit into this scheme. As has been demonstrated by Singer, the contribution of electrons to the magnetic field of the drift currents should be insignificant due to the small radius of curvature of their spirals. For this reason, one has to presume that the magnetic field of the radiation zone is created, in the main, by drift currents of protons and positive ions.

Aurorae, the spectra of which reveal hydrogen lines, indicate the possibility of protons existing in the radiation zones.

A joint consideration of the results of measurements of the magnetic field and of corpuscular radiation carried out on the first space rocket shows that the biggest magnetic effects associated with the outer radiation zone were observed closer to the earth than the intensity maximum of corpuscular radiation. If a similar relationship was observed also during the measurements by space rocket II, the field maximum of the outer radiation zone could remain undetected by the rocket, owing to the fact that this maximum belonged to a region where the magnitude of the magnetic field of the earth extended beyond the limits of measurement of the magnetometers.

Measuring the magnetic field of the moon.

The magnetometer of Space Rocket II was designed to detect a lunar magnetic field. It functioned normally right up to impact of the container on the moon. The last measurement was made at approximately 50 km. from the lunar surface.

Measurements did not detect a lunar magnetic field.

An analysis of the precision of measurement of the magnetic field of the moon and the precision of telemetry recordings of the measurements permit of drawing the conclusion that if the moon had a magnetic field, whose intensity at the lunar surface exceeded I00 gammas, it would have been detected.

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Thus, the moon does not have a considerable magnetic field. At any rate, it may be asserted that the intensity of the lunar magnetic field at the surface of the moon is at least less by a factor of 400 than the intensity of the magnetic field at the surface of the earth. This means that the mean value of magnetization of the moon does not exceed 0.0002 CGS, i.e., does not exceed 0.25 % of the mean value of magnetization of the earth.

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(6) RADIATION MEASUREMENTS DURING THE FLIGHT OF THE SECOND SOVIET SPACE ROCKET

by

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ABSTRACT

The apparatus for investigating radiation installed in the Second Soviet space rocket that was launched moonwards on Sept. I2, I959 was designed to obtain new data on the outer radiation belt of the earth, to register cosmic radiation between the earth and the moon, and also to detect a lunar radiation belt if such exists.

The instrumentation and the volume of measurements were increased over the First Soviet Space rocket (I). What is more, a part of the radiation-recording instruments was positioned outside the pressurized container (at a distance of 56 cm. from its surface), thus making it possible considerably to reduce the shielding of these instruments.

The entire outfit of measuring apparatus consisted of 6 gas-discharge counters and 4 scintillation counters.

I. Data on the spatial position of the outer belt of radiation.

The trajectories of the First and Second space rockets relative to the magnetic field of the earth, and the results of ionization measurements are shown.

The trajectories of the rockets differ very slightly : the flight path of the Second space rocket passes through the zone of high intensity some 200-300 km closer to the plane of the geomagnetic equator than that of the First rocket. This shift in the trajectory cannot be responsible for the altered shape and displacement of the maximum of the intensity-versus-height curve and only emphasizes this difference.

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The general picture of the deformation of the zone of high intensity of September I2 relative to its position of January 2, I959 amounts to a shifting of the zone in the direction of the internal regions of the magnetic field.

The intensity maximum of September I2 is observed at a distance of I7,000 km. from the centre of the earth on line of force 59°(i). On January 2 the maximum of intensity was observed at a distance of 27,000 km. and on line of force 63°.

What are the causes of the observed deformation of the outer radiation belt ? It should be pointed out that the flights of the First and Second space rockets were made over trajectories that were extremely close as regards the relative geographical coordinates, but were essentially different as regards the direction to the sun ; this could reveal a systematic deformation of the magnetic field of the earth. However, it is more probable that the deformations of the outer radiation belt are associated with the variable character of solar corpuscular streams and, accordingly, with the variable nature of particle injection into the zone of high intensity. Supporting this view is the difference (observed in the experiments of Jan.2 and Sept.I2) in the energy spectrum of the particles, and also a comparison of the general trend of intensity with the data obtained by the United States Pioneer-3 rocket (2). In the latter case, the flight path relative to the solar direction was close to that of the First Soviet space rocket. Nevertheless, the intensity maximum was recorded at a distance of 22,000 km. from the earth's centre on a force line intersecting the surface of the earth on geomagnetic latitude 57°, that is to say, in better agreement with the data of the Second Soviet space rocket and not the First.

2. The composition of the radiation in the outer radiation belt of the earth

The counting rate of the scintillation counter with the 3.5 Mev threshold confirms the fact (to a considerably higher degree of accuracy than was done on Space Rocket I) that particles with a range of several g/cm^2 are absent in the outer belt. In this case, too, the slight increase in the rate (about 30 %) in the region of the maximum is possible due to superpositions of counts of lesser amplitude.

(i) The force line is denoted by the geomagnetic latitude on which it intersects the earth's surface.

Thus, the electron flux of energy $\geqslant 5$ Mev (or of protons of energy $\geqslant 30$ Mev) amounts, even in the maximum of the zone, to less than one particle per $cm^2 sec$.

Essentially new data have been detected on the basis of the readings of gas-discharge counters situated inside the container and shielded with supplementary filters made of copper and lead. The data of the scintillation counter with the 3.5 Mev threshold show that the rise in the count in counters cannot be due to charged particles penetrating the shell of the container. This means that both counters recorded photons. In as much as the counting intensity in this counters differs by only a factor of $I\frac{1}{2}$, it is necessary to attribute to these photons a relatively high energy (over 400 Kev).

In principle, two explanations may be suggested for the appearance of photons of the observed energy :

I) at the expense of x-radiation of electrons of energy of the order of $I0^6$ ev.

2) the second possibility is the production of induced radioactivity in the shell of the container due to bombardment by protons of energy $\sim$I0 Mev. Just as in the case of electrons, the proton spectrum should have a sharp out-off on the side of high energies (protons with energy over 30 Mev are practically absent).

Right now, the first version appears to be most probable. But even in this case the energy particle of the particles (electrons) turns out very unexpected. An estimate of the flux of electrons of energy $\sim$2 Mev in the maximum yields a value of $\sim 5 \times I0^5$ particles per $cm^2 sec$, a flux of electrons of energy 5 Mev (as already stated) is less than one particle per cm2sec. On the other hand, experiments on the First space rocket revealed an exceedingly large flux of electrons of energy 20 to 50 Kev, namely : $I0^{I0}$ particles per $cm^2 sec$. This soft part of the electron spectrum was also detected in the experiment on rocket I at the edge of the zone by means of scintillation counters.

3. <u>The search for enhanced radiation near the Moon</u>

Approach to the moon to a distance of I000 km. from the lunar surface did not reveal an increase in the intensity of radiation within I0 % of the cosmic background. It was difficult to obtain accurate data over the range 0 to I000 km. from the lunar surface due to short flight time over this part of the trajectory ; even so, no considerable increase in intensity was detected at these heights.

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If we compare the radiation intensity in a hypothetical lunar radiation belt with the maximum in the outer belt of the earth as based on readings of the detector-scintillation counters most sensitive to soft radiation, we find for heights > I000 km. a ratio of intensities 10^{-6} or less, and for heights from 0 to I000 km. -- 10^{-4} or less. Thus, it may be considered that, practically speaking, no lunar belt of radiation exists.

If it is assumed that the existence of the outer radiation belt and the particle intensity in it are determined by the intensity of the magnetic field, then the intensity of the terrestrial magnetic field at the boundary of the outer belt gives also the upper limit of the magnetic field at the surface of the moon. This limit comes to 10^{-3} of the field at the earth's surface.

4. Measuring cosmic-ray intensity

After emergence from the outer radiation belt of the earth, at a distance beginning with 70,000 km. from the earth's centre, and on the lunar section of the flight path, all instruments recorded a constant intensity. The positioning of a part of the instruments outside the container yielded a perceptible result in the sense of reducing the contribution of the secondary radiation produced due to the action of cosmic radiation.

Table I lists the measurement data of space rockets I and II for different components of radiation. The data obtained are in sufficiently good mutual agreement. The purest data on the intensity of primary cosmic radiation is given by the bottom row in the table (instruments outside container).

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2. J.A. Van Allen and L.A . Frank, Nature, I83, 430 (I959)

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TABLE I *

Date	Position of instruments	Gas-discharge counters, intensity particles/cm2sec.	Scintillation counters: Threshold energy	Scintillation counters: Intensity *****	Ionization in crystal of weight I80 gm.
Jan.I.59	Inside container	2.3 ± 0.I	4.5 Mev 450 Kev 45 Kev	I.9 ± 0.I 3.0 ± 0.I5 6.75 ± 0.3	I.42:I0^{9} ev/sec 0,05
Sept.I2.59	Inside container	2.46 ± 0.I ** 2.45 ± 0.I ***	3.5 Mev 600 Kev 60 Kev	2.I2 ± 0.I 2.77 ± 0.I5 6.7 ± 0.3	I.55 x I0^{9} ev/sec 0.05
Sept.I2.59	Outside container	I.98 ± 0.I ****	450 Kev	2.02 ± 0.I	I.I5xI0^{9} ev/sec 0.05

* Errors characterize maximum spread in the area of the detectors.

** Counter with supplementary shield I.5 mm Cu.

*** Counter with supplementary shield 3 mm. Pb.

**** Counter with supplementary shield 3 mm. Pb.

***** The number of counts per second related to unit area of the crystal (I9 cm^{2}) is indicated.

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(3) TERRESTIAL CORPUSCULAR RADIATION AND COSMIC RAYS

by

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ABSTRACT

I) In cosmic space exist such conditions that the total energy of high energy particles is comparable to the energy of the magnetic field and to the kinetic energy of atoms. For this reason the properties of cosmic space are determined by processes of energy transfer to high energy particles and back again. Within the vicinity of the earth the strength of the magnetic field is very great. Therefore, if the above mentioned conditions are ful-filled, the intensity of radiation around the earth may be very great. During the flight of USSR satellites and USA satellites, outer (I) and inner (2) radiation belts were observed.

During several orbital passages of Sputnik II (from Nov. 3rd to Nov.9th, I957). an anomalous increase of the number of particles was observed to the north of 60 degrees geographical latitude. An especially large increase was observed on the 7th of November I957. By means of Sputnik III (from May I5 - Aug.I5, I958), it was found that in each case - without exception for more than 300 observation - X-rays with energies of IO^5 ev. were present at high latitudes ($\sim 60°$N). A comparison of data obtained at various altitudes, 300 to 500 km, in the northern hemisphere, shows that the intensity increases along the lines of forces of the magnetic field. This is experimental proof of the existence of particles being trapped by the earth's magnetic field. The data obtained in Antarctic show that at altitudes of I800 km, the intensity is greater by a factor of 40, in comparison to the intensity at 400 km. During the flight of the first USSR cosmic rocket, the maximum intensity was observed at a distance of 26,000 km from the center of the earth. There, the intensity was I6 times greater than the intensity at I800 km. (along the magnetic force line which intersects the Earth at 63°N). During the flight of the second USSR cosmic rocket, the maximum intensity was observed at I7,000 km. along the magnetic force line of 59°N. In this case the intensity was greater than in the first case.

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2) The boundaries of the outer zone are the lines of force of the geomagnetic field. At comparatively small altitudes, 300 to I500 km, the outer zone is observed in the interval of geomagnetic latitudes 55°-70°. The outer zone in the equatorial plane begins at a distance of about 20,000 km. from the center of the Earth and extends to 60,000 km.

3) The measurements made by means of scintillation counters show that the particles comprising the outer zone are electrons. The electron flux with energy exceding 0.5 - $I.I0^6$ ev. at the maximum of the outer zone is $I0^5 cm^{-2}$ sec^{-I} $sterad^{-I}$. The electron flux with energy greater than $5.I0^6$ ev is less than $0.Icm^{-2}$ sec^{-I} $sterad^{-I}$. The electron flux with energy greater than 2 x $I0^4$ ev corresponds to $I0^9 cm^{-2}$ sec^{-I} $sterad^{-I}$.

4) A great fluctuation of intensity was observed in the outer zone. The intensity was greater during the following times : I6 - 23 of May, 6 - I7 of June, 8 - I6 of July, 6 - I6 of August I958 (obtained from Sputnik III).

5) The inner zone in the equatorial plane begins at a height of 600 km, in the Western Hemisphere and extends to distances of the order of the Earth radius. The boundary of the inner zone is a line of force intersecting the earth at geomagnetic latitude of 35 degrees. A comparison of the measurements along the same lines of force of the magnetic field, but at different altitudes, shows that also in the inner zone the particles are trapped and oscillate along the lines of force.

6) The radiation intensity in the inner zone remained constant in the course of one month (from I5 of May to I5 of June I958) at least to an accuracy up to I5 %. From I5 June to I5 August I958, radiation intensity fluctuations are greater ±30 %). This is probably connected with magnetic disturbances.

7) Particles comprising the inner zone are protons of energy close to $I0^8$ ev (this data was obtained from ratio $\frac{\text{dynode current}}{\text{anode current}}$ and induced radioactivity).
The flux corresponds to $I0^3$ protons cm^{-2} sec^{-I} $sterad^{-I}$.

8) On the edge of the inner zone, approximately in the interval of geomagnetic latitudes 35° - 40°, low energy radiation is observed (less than $I0^6$ ev), which apparently consists of electrons. It is natural to expect that this radiation is also present in the inner zone.

An examination of data suggests a relationship between variations occurring in the outer and inner zones.

9) Between the two zones, in an interval of geomagnetic latitudes 40°-55°, there is observed a region where elevated radiation intensity is practically absent. Proceeding from the

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precision of the measurements made, it may be stated that the flux of electrons of energy exceeding I00 kev in this region at altitude 300 - 700 km. is less than $I0^{-3}$ of the flux within the outer zone. The flux of protons of energy greater than $I0^{8}$ ev is less than $I0^{-3}$ of the same flux in the inner zone.

I0) Outside the magnetic field of the Earth, radiation consists of protons and other nuclei. The total flux is 2 particles cm^{-2} sec^{-I}. The mean ionizing power of charged particles of high energy is 2.5-fold that of the minimum ionization ~~power~~. In interplanetary space, the flux of photons of energy $h\nu > 450$ kev is less than 0.I photon cm^{-2} sec^{-I}, and with energy $h\nu > 45$ kev it is less than 3 photons cm^{-2} sec^{-I}. Thus, hard electromagnetic radiation does not play an essential role in outer space.

During the flights of space rockets I and II, no variations of the above-mentioned components of radiation were discovered to exceed several percent with the averaging time I0-20 min.

II) A comparison of experimental data with theoretical reasoning shows that high-energy protons in the inner zone can originate from the decay of albedo neutrons. The radiation intensity in the centre of the inner zone at small altitudes is determined by ionization losses of protons in the upper layers of the atmosphere. At geomagnetic latitudes above 30° and, accordingly, at high altitudes in the plane of the equator, the intensity begins to fall off sharply due to imperfection of the magnetic trap at these latitudes. This imperfection of the magnetic trap is almost the same both for high-energy particles and for low-energy particles (see point 8, Conclusions). For this reason, it seems highly improbable that the imperfection of the magnetic trap is connected with non-conservation of magnetic moment of the particle.

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9 COSMIC RAY INV[redacted]E SECOND COSMIC ROCKET LANDED ON THE MOON

by

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ABSTRACT

Cerenkov counters were used for recording primary cosmic ray nuclei. The breakdown thresholds of the instrument were set in such manner as to record α particles and more heavier (the first threshold), particles with $Z \geqslant 5$ and $Z \geqslant 15$ (the second and the third thresholds accordingly. A plexiglass cylinders 26 mm in diameter and 26 mm high served as the detectors.

There was a separate canal (apart from three canals mentioned above) for detecting the intensity of all charged particles in the radiation belts. This canal was named "monitor of radiation". Cerenkov counter's photomultipliers are sensitive to X-rays, therefore the "monitor of radiation" can detect the bremstrahlung radiation which appear in the shell of the container by the action of charged particles.

The "monitor of radiation" found out a radiation belt its maximum being situated at the distance of I7.000 km. from the centre of the Earth. The maximum of radiation belt detected by the identical monitor of radiation during the flight on 2 January I959 was situated at 27.000 km from the centre of the Earth.

The "monitor of radiation" has not found out any detectable increase of the intensity near the Moon : the counting rate was inchanged in limits of measurements accuracy equal to the counting rate of cosmic rays.

At the great distance from the Earth the counting rates in the Cerenkov counters were equal to $23,5 \pm 0,2$; $I,9 \pm 0,06$; $0,08 \pm 0,0I$ counts per minute for the particles with $Z \geqslant 2$; $Z \geqslant 5$; $Z \geqslant I5$ correspondingly. The rations of ~~fluxes~~ of corresponding groups on nuclei are I000:75:3.

At the distances of I0000-30.000 km from the center there was an appreciable increase of the counting rate in the canal intended to detect α particles. It is difficult to interpret at present such increase. It is possible this result may be accounted for by the effect of the radiation belt on the instrument, but there is a chance that the energetic α particles are accumulated on the orbite circulating the Earth.